SHAASTRA - 2014
Trained for SPACE
Problem Statement (Round 2)

1. Overview:

It is 2015. Finally, after a lot of hard work, brainstorming and iterating, your time has come. T-20 and the radio communications have been checked, fuel has been stowed, all the control systems and running and the nation is waiting with bated breaths. The countdown begins, your heart starts beating faster than you thought was ever possible. After all, this could be defining moment not only for your career but also for the nation's space history.

Nine seconds before lift-off, all the five engines of the rocket ignites, sending a sheet of flame over the spindle shaped island of Sriharikota . Twenty minutes after lift-off, your rover is 500 kilometres above the sea level and cruising at the gentle speed of around 38,500 kmph.

5 days later, the time has come for you to prove what you are capable of. Your rover is now on the lunar surface and it has a mission that it must complete. Are you and your machine up for the BIG task? Let's find out what you need to do!

2. Mission:

The objective of this event is to develop new technologies or apply existing technologies in unique ways to create a robot (Moon Rover) to explore the surface of the moon. The robot (**autonomous/remote controlled from the Earth Zone**) will have to navigate **150m** of unknown terrains, avoiding obstacles (Later mentioned in Section 4) in the given period of time.

3. Robot (Rover) Specification:

3.1 The weight of the robot may not exceed 10 kg.
3.2 The dimensions of the robot may not exceed 12in x 12in x 9in(inches) in its starting configuration.
3.3 The robot may exceed the given dimensions after its starting, if required.
3.4 Robot must have onboard camera(s) for Image Processing. No other external cameras are allowed.

4. ARENA:

The Challenge area will have two zones: **Moon Zone** and **Earth Zone**.

Moon zone is the region where the robot will travel to achieve the mission. Moon zone will have dimension **28m x 14m**. It will be fenced with a 30cm high wall. The robot should travel 150m within this region. It will be an unknown rough terrain consisting of uneven ups and downs, moon craters, flat regions, inclined planes and lots more. This zone will contain a lot of obstacles of various sizes which the robot has to evade. Moon Zone will have random checkpoints at various places. These checkpoints will be disclosed only during the event.

Figure 1: 3-D View of Moon Zone
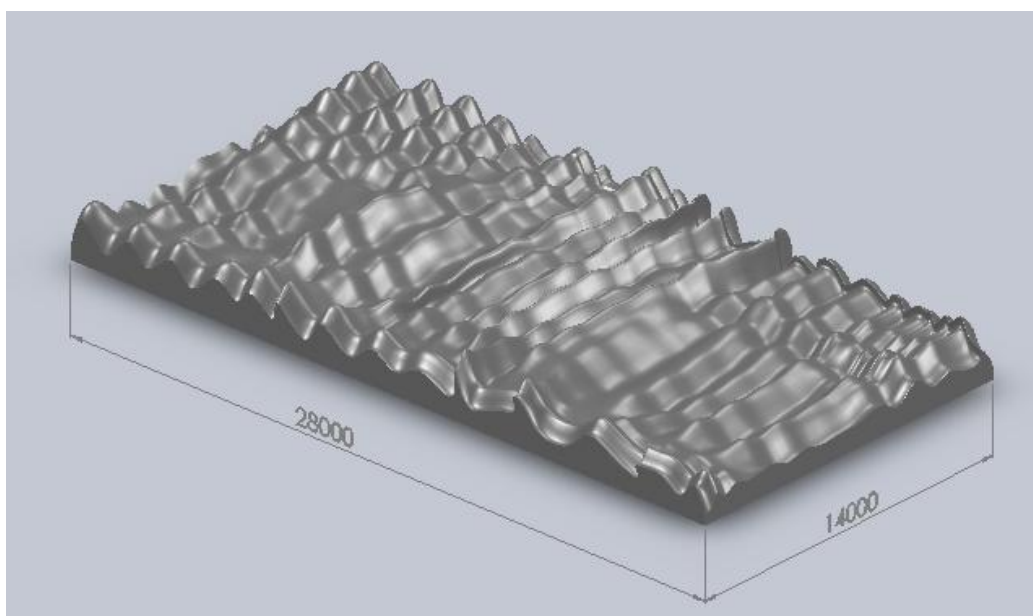
This region will have a spaceship from which the robot will start. The robot will be placed in a platform inside the spaceship at a height of 1m (from Ground surface). The dimensions of platform will be 35cm x 35cm. The robot can be placed anywhere in the platform but it should fit in the platform before starting. Spaceship and moon's surface will be connected by an incline at 45 degrees.
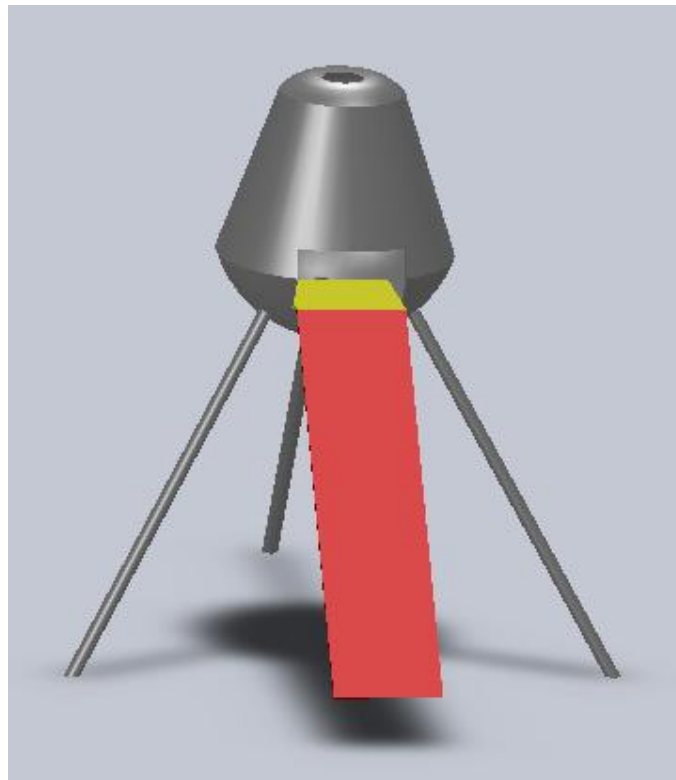

Figure 2: 3-D View of Spaceship

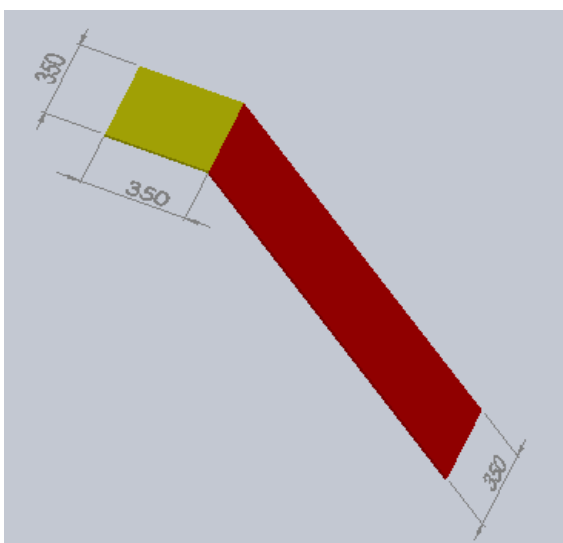All Dimensions in the pictures are in mm.
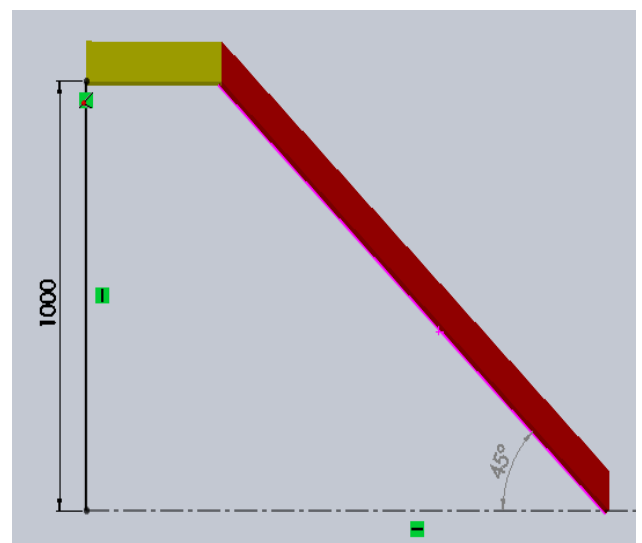

Figure 3: 3-D View of Platform

Figure 4: Platform

Earth Zone will be a **5m x 5m** box near the moon zone. Team members and Event officials will stay in this zone. All the communication should be sent to this 'Earth zone'. Moon zone will not be visible from Earth Zone. Robots will be tested in Earth Zone before starting in Moon Zone.

 All dimesions will have a tolerance of 5%.

Rough terrain mentioned in the pictures are just for understanding.Same arena **will not** be replicated during the event.

Testing of Robot in Earth Zone:

Before entering the Moon Zone, the robot will be tested in Earth Zone. Robot will have to travel in a straight line for 4m. This is to ensure that distance calibration is correct and the robot is perfect with respect to locomotion. A tolerance of 5% will be given to the teams for the measurement.
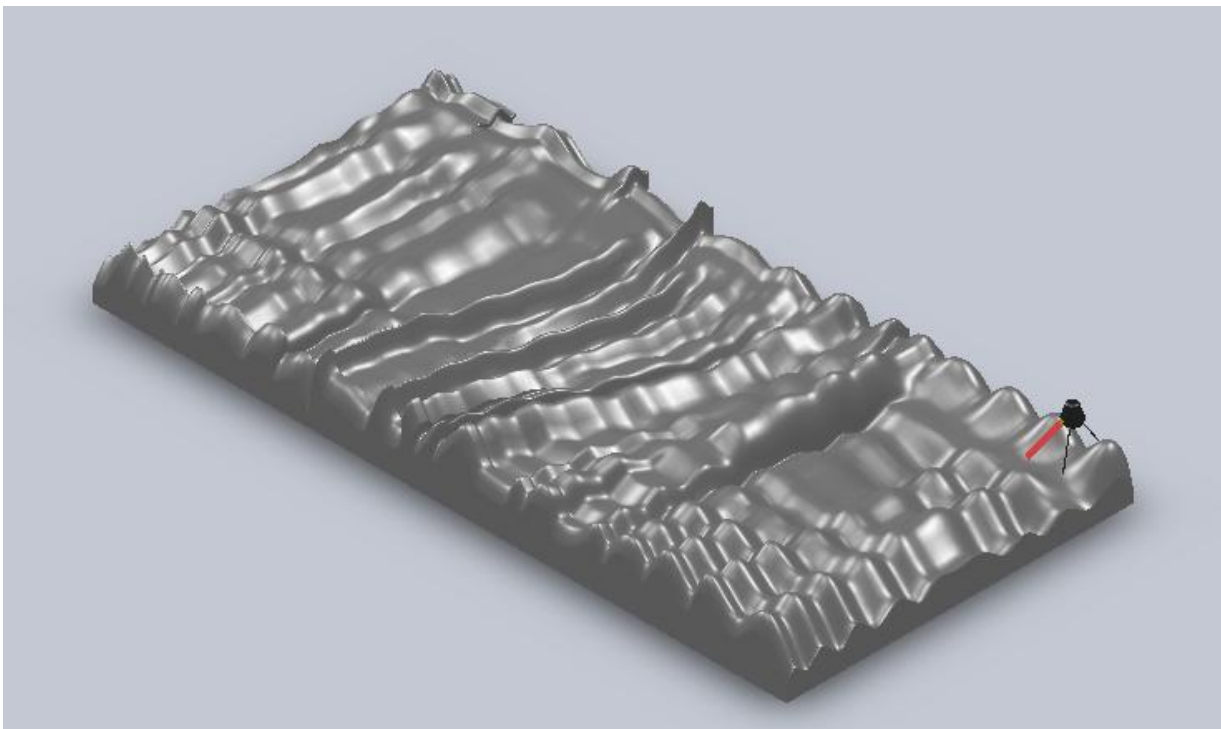

Figure 5: 3-D View of Complete Arena with Lander

5. Challenges:

5.1 Navigation:

The robot (controlled autonomously/ by remote from Earth Zone) has to start from the platform (as mentioned in Section 4) inside the spaceship, get down the incline and travel 150m in the given rough terrain by avoiding obstacles.

5.2 Communication:

During its course of navigation, the robot has to send the distance traveled in the moon zone to the earth zone. The distance should be updated atleast once in 10 sec.

The robot has to send atleast one picture or a video to the earth zone. The first picture or the video sent by the robot should be received in earth zone before the robot travels 100m. A team can send atmost five pictures or video (i.e. the sum of number of pictures and videos can be five at maximum).

Participants will be provided with a wifi router for communication during the event. Participants can also try any other means of wireless communication. Participants have to take care of the requirements for the same if they are using other means of communication.

6. Safety Features required in robot:

6.1 Master Power Switch:

The Master Power Switch must be an identified, and easy to access on-off switch. This switch must turn on power to ALL parts of the robot, including any on-board processing components. One of the team member will trigger this switch at the start of the competition run when time begins. The robot can have only one Master Power Switch. This will also be the emergency stop switch.

6.2 Safety Light:

Each robot must have an easily viewable indicator light which is turned on whenever the main powerof the robot is turned on. The light must be red/orange in color and solid

when the robot is operating. The light should be clearly visibly even during the daytime.This light should be switched off when the robot is non functional.

7. Rules and Regulations:

7.1 The robot can start only by switching on the Master Power Switch. No other kind of triggering will be entertained.

7.2 During the challenge attempt,no team member is allowed inside the Moon Zone.

7.3 In case of any emergency/ restart, two team member can enter the moon zone with the consent of the event officials or the co-ordinator.

7.4 In case of autonomous, no communication should be sent to robot after switching on the Master Power Switch.

7.5 Communication can only be wireless and no form of wired communication is allowed.

7.6 In case of remotely controlled, the pictures or videos should get stored in the computer in the Earth Zone.

7.7 In case of autonomous operation, the pictures or videos can be either stored in the computer or displayed directly.

7.8 Communication sent to any other place other than earth zone will not be considered.

7.9 The Event official can cross check the system for any mishandling with communication.

7.10 In case, the first picture (or video) sent to Earth Zone is after traveling 100m on Moon Zone, then any further pictures(or videos) sent will not be considered for scoring.

7.11 The robot should not travel in the exact same path again and again. For example, robot should not move in a same circle always or travel to and fro.

7.12 A tolerance of only 5% error is allowed for distance measurement during the calibration check in the earth zone.

7.13 Each trail will go on for a maximum of 5 minutes.

8. Restart:

Teams can ask for a restart if anything goes wrong with the robot. The robot can be restarted from the same place with a penalty as mentioned in the scoring part. The team can ask for a restart bypassing an obstacle or a rough terrain with extra penalty.

9. Disqualification:

9.1 A robot and team may be disqualified from the competition for violation of rules at any time prior to, during, or after a challenge run at the discretion of the event officials.

9.2 Disqualified robots will not be allowed to participate in the challenge, continue with their challenge run, or win any prize money.

10. Scoring:

10.1 The teams will be awarded 100 points for every 25m it travels.

10.2 The teams will be awarded a bonus of 100 points for traveling the whole 150m without any restart.

10.3 The teams will be penalized by 50 points for each restart the team requests.

10.4 Any restart bypassing an obstacle or a rough terrain will be penalized by an extra 25 points more than the previous case.

10.5 The teams will be penalized by 25 points for hitting an obstacle or the wall.

10.6 The teams will be awarded 10 points for updating the distance travelled each time.

10.7 In case of failing to update the distance traveled every 10 sec, the team will be penalized by 10 points.

10.8 For every picture the robot sends to earth zone, the team will be awarded 50 points.

10.9 Sending a video is not mandatory for participants. But if the team sends a video to the earth zone, Then the team will be awarded150 points.

10.10 It is compulsory for the robot to cover all the checkpoints (The positions of checkpoints will be disclosed only during the event). For covering each check point team will be awarded 50points. For every check point missed at the end of the trial a penalty of 25 points will be awarded to the team.

11. Judging Criteria:

11.1 Round 1:

　　11.1.1 Registered Participants have to make a presentation on the technical details of their robot (rover).

　　11.1.2 More details will be put up on the website soon.

11.2 Round 2:

　　11.2.1 Only the teams that has traveled 150m will be considered for the top 5 positions.

11.2.2 Total Score(Score of Navigation + Communication) of teams satisfying the above criteria will be arranged in descending order and top 5 teams will be selected for Round 3.

11.2.3 If none of the team completes 150m , then the total score of all the teams will be listed in descending order and top 5 teams will be selected.

11.2.4 In case of a tie break, teams with more points with communication will be preferred in both the above cases.

11.3 Round 3:

Problem statement and judging criteria for Round 3 will be released soon.